Review of Pierce County Manual/Ordinance Re-submission dated August 2008

November 7, 2008 Ed O'Brien

January 30, 2009 Responses by Dennis Dixon, Pierce County PW&U-SWM

February 9, 2009 ECY Response to Pierce County

Note: The following comments in black are from Ecology to Pierce County (11/7/2008) regarding manual equivalency. Pierce County responded to those comments in red (1/30/2009) and Ecology followed up with comments in blue (2/9/2009).

Introductory Comment: Is it possible to view the changes that have occurred in Volume I through V since the draft version previously reviewed by the Dept. of Ecology? This would facilitate a quick review. We started making changes with "track changes" enabled but after we made wholesale cut and paste from different sections it became cumbersome and quite confusing to identify what was being done. So we do not have a full track changes version for you and if we did I don't believe it would have facilitated a quick review. Also, the County should supply Ecology with a listing of any significant changes from the draft previously reviewed by Ecology.

The following four comments are Ecology's recommendations to the County. They are not pre-conditions for permit compliance. The comments reference a numbering system corresponding to the numbers in the Ecology comments/Pierce County responses document. Pierce County has provided an adequate response to all other Ecology comments except for those on Volume VI below.

10. The first sentence in the last paragraph on page 2-16 is true but leaves a false impression. The PGIS surfaces that meet the design criteria for Concentrated Flow or Sheet Flow Dispersion are still modeled as Pollution-generating Pervious Surfaces. This is very similar language to the 2005 DOE manual (pg 2-30) and I believe serves to direct the applicant to use preferred BMP's for dispersion. We don't believe this is the section to bring up all the nuances of runoff treatment criteria, those can be found in other volumes.

34. Ecology Embankment maintenance: The maintenance table should indicate that the media materials need to be replaced on a 10-year cycle. Ecology could allow a caveat that 10-year replacement may be avoided if monitoring verifies that significant cation exchange capacity remains in the bed. While this is not mentioned in the 2005 DOE Manual's or in DOE's GULD guidance on Ecology Embankments we do see this in the 2008 Highway Runoff Manual's criteria for "Media Filter Drain" (Table 5.5.10) we see the efficacy of it and plan to add the WSDOT "replacement" language to our Maintenance table item #22.

54, 55, 56, and 57: For sizing Sediment ponds, traps, spillways, and emergency overflows, the County requires use of flows produced by a continuous runoff model using 15 minute time steps. At this time, the WWHM does not provide flows in 15 minute time steps (except for the WQ treatment flow rate). That is why Ecology suggested text language for scaling up the hourly flow rates. Alternatively, if the Pierce County version of MGS Flood provides flow rates in 15 minute time steps, the manual could direct the user to use MGS Flood exclusively until such time as WWHM provides 15 minute time steps. The applicant can always make the case for the

scaling up method to be technically equivalent (PCC 17A.10.090) until such time as WWHM functionality meets other approved hydrologic models.

70. Ecology supports use of the on-line water quality flow rate as modified by the correction factor in Figure 8.5a as an appropriate rate at which bypass of a vault may occur. However, Ecology has only required use of the ratios in Figures 8.5a and 8.5b, when sizing flow rate-based facilities that were previously sized using peak flows from a single event model. Biofiltration swales, vegetated filter strips and oil/water separators are the only facilities which use the correction factors. Correction factors do not have to be used for new flow-rate based designs, such as various types of media filters in canisters. Wet vaults are sized using the 91st percentile 24-hour runoff volume. They are not sized using a flow rate. So, use of a correction factor to determine a water quality design flow rate is not necessary. However, using the correction factor to increase the flow rate threshold at which overflows can occur ensures more flows will be directed through the vault. As indicated in our earlier comments, the Dept. of Ecology suggests that bypasses only be allowed in vaults that exceed a specified length to width ratio. Standard design criterion for ponds is 3:1. Ecology does not allow bypasses of ponds. So, vaults with L:W ratios at or below 3:1 should not be allowed to bypass.

The County will only allow a wet vault when it has been shown to the County's satisfaction that all other water quality BMPs are not practicable (Vol. V pg 9-12). In the 2005 DOE manual it is noted that wetvaults are used when space limitations preclude the use of other BMPs and are highly discouraged for residential use. We have made the use of this marginal BMP even further restricted in the Pierce County manual relative to the Ecology manual. We still have strong reservations about having a Wet Vault on line over concern for re-entraining settled out pollutants and sediment and do not agree with the requirement to "treat" flows greater than the 91st percentile design, which is implied by having the BMP on line. Although the DOE manual does not account for an off line application of the BMP, we have added the reference to the flow rate conversion table in the DOE manual simply to be consistent with other off line runoff treatment BMPs, even though there are modeling tools that can make direct calculations of the Water Quality bypass rate.

No Ecology response is necessary to the above statements as the Ecology comments were advisory to the County.

Comments on Volume VI

As indicated by the previous submittal, this section has been significantly re-worked. These are Ecology's comments on the new format and content. An adequate response is necessary for permit compliance.

1. Section 3.8.2 Bioretention Facility Design

a. The "Soils" section requires 18 inches of treatment soil. That is consistent with Ecology's design. The section goes on to refer the reader to Section 3.1.4 for soil mix requirements. That latter section describes options concerning how to meet the soil quality and depth require ment for: 1) soils within stormwater drainage systems and landscaped areas, and 2) lawn areas. Assuming that the County intends the reader to use #1 above for bioretention facilities, the

specifications do not provide adequate direction to the reader concerning options to create an 18– inch soil profile that approximates a 10% organic content. We suggest that the County could have separate instructions for landscaped areas and bioretention facilities. The latter could be simply scaled-up versions of what is specified for landscaped areas.

Section 3.8.2 refers the reader to the soil mix requirement found in Section 3.14 and the County would consider the Bioretention Facility to be a Stormwater Drainage System not a Lawn Area so the 10% Organic Content requirement would apply. We agree that more clarification can be added to this section but we also list additional guidelines for this BMP which include the DOE Manual's BMP T5.13, and the *Soils for Salmon* website. We understand more work is being done to produce a regional soil standard and will include that information when it becomes available. Additionally if Ecology updates the guidance in BMP T5.13, which we direct the engineer to, this will also provide the additional guidance you are suggesting. We believe that our current version meets the technical equivalency standard with the 2005 DOE Manual.

The County must change Section 3.8.2. The current text is acceptable for "rain gardens" (Pierce County's definition) that are built within projects or threshold discharge areas that do not exceed the thresholds for treatment or flow control facilities. In particular, the text within the third and fourth bullets on page 3-15 are not compatible with design of bioretention facilities that serve any part of a threshold discharge area exceeding the treatment or flow control thresholds (5,000 ft2 PGIS, 10,000 EIA, ¾ lawn or landscape) .

The core design criteria for bioretention facilities are in Appendix III-C of the '05 SMMWW. The PSAT LID Technical Guidance Manual has additional criteria. The core design criteria require use of a combination of a loamy sand and compost to provide the needed soil quality and depth. Section 3.8.2 allows other options similar to what is allowed in BMP T5.13 and the Soils for Salmon website. But BMP T5.13 and the referenced website are intended to provide options applicable to all lawn and landscaped areas, not bioretention facilities.

b. For facilities serving areas larger than 2,000 sq. ft., the text requires continuous runoff modeling and use of the assumptions in Table 3.2. For facilities serving all or any part of projects that exceed 10,000 square feet impervious surface, 5,000 square feet of PGIS, ¾ acres of lawn, or areas with a 0.1 cfs increase in the 100-year flow frequency, the assumption in Table 3.2 for the bioretention soil infiltration rate is not approvable. Pierce County's specifications allow a wide range of imported soil or amended native soil mixtures. Those mixtures will have a wide range of infiltration rates. Use of one rate for the imported soil mixture is not appropriate. Likewise, use of the native soil rate before the amendment seems inappropriate too. If the facility is going to be used to completely or partially meet the treatment or flow control requirements, there must be better quality control in estimating long-term infiltration rates of the bioretention soil. Please refer to page C-16 of Appendix III-C of the '05 SMMWW for the recommended method for infiltration rate determination.

As another alternative, the County could tightly specify a soil mixture for which it provides the reader with an assumed initial infiltration rate based upon testing. A specification from Curtis Hinman for a sand/compost mixture is available. Dr. Hinman's study indicates that for the sand, the percentage of materials passing the #200 sieve is critical for determining the final infiltration

rate. A 2-3 % amount passing that sieve seems to provide infiltration rates in the correct range (i.e., around 9 inches per hour).

We agree that a correction needs to be made in either a tighter soil specification or infiltrations testing method for Bioretention facilities. Since soils are a very difficult item to specify, obtain and certify we are choosing to change the infiltration testing method. Our proposed solution is to change Table 3.2 for the Bioretention Soil Infiltration Rate row and for the assumption to refer to a new section **4.3 Bioretention Infiltration testing**. This will be a direct copy the language found in the 2005 DOE SWM manual Appendix III-C section 7.7.4.1 on page C-16. In the interim before these changes can be adopted by Council we will issue a "letter to industry" announcing this change as a temporary policy standard.

The County's proposal may be generally acceptable. But there isn't clarity on the extent of facilities that would have to verify infiltration rates through testing. The permit requires that there be a reasonable way to estimate the overflow discharge rates and volumes from all bioretention facilities that serve any size drainage if the facilities are within a threshold discharge area exceeding the treatment or flow control thresholds. Thus, even a "rain garden" serving a single residence must meet the minimum design criteria for soil quality and depth; must use approve methods to estimate infiltration rates; and must be represented in an approved continuous runoff model. In order to not discourage use of bioretention facilities through requirements for infiltration testing , Pierce County may want to allow a standard design proposed by Seattle and Tacoma. Bioretention facilities that use a specified aggregate and compost mix can use an assumed infiltration rate for the mixture. We can forward the specification to you. Based on testing done by the City of Seattle and Dr. Curtis Hinman, the bioretention mix is assumed to have an infiltration rate of 6 inches per hour. For design purposes, bioretention facilities serving over 5,000 PGIS, 10,000 EIA, or ¾ acre lawn/landscape areas reduce this by a factor of at least 4, resulting in a max. design infiltration rate of 1.5 inches per hour. Bioretention facilities serving drainage areas less than the above thresholds for the soil component, may use a correction factor of 2, for a design rate of 3 inches per hour.

Even with the standard design described above, whenever a bioretention facility or a rain garden is part of a drainage area exceeding the treatment or flow control thresholds, the infiltration rate of the underlying soil must also be estimated in order to represent the facility in the runoff model. The manual provides three methods to do this. No correction factor is necessary. Then, the modeling procedures described in Appendix III-C or Chapter 7 of the LID manual may be used.

c. The text on page 3-19 seems to require that bioretention facilities serving larger than 2,000 sq. ft. must fully meet the flow control standard. This seems like an unnecessary restriction that will be an unfortunate disincentive to use of bioretention. The County could allow facilities that do not fully meet the flow duration standard but which can achieve a significant amount of flow reduction. The WWHM and MGS Flood allow project designs that incorporate bioretention facilities serving all or just part of the project. The outflow(s) from the bioretention facility (or facilities) can be summed by WWHM to create a post-development runoff file that can be compared against the flow duration curve compliance standard. If the post-development file does not meet the standard, a retention or detention facility can be designed to make-up the difference.

This section on Modeling and Sizing allows for the sizing of facilities serving less than 2000 s.f. to use Table 3.1 but larger area to be sized by an engineer. I do not see how this will be "an

unnecessary restriction" or "disincentive" since we are only requiring the applicant to meet the "**applicable** flow control requirements". In some cases a project may not require flow control but select Bioretention to meet runoff treatment requirements and we have the added benefit of infiltration that was not mandated. Additionally we allow multiple facilities to be constructed so if flow control is required at a site one facility is not required to meet the full flow control standard but the aggregate of the facilities must meet the applicable requirements.

See the above comments. Wherever a facility is part of a TDA that exceeds the treatment or flow control thresholds, and treatment or flow control credit will be given, the design must meet the soil quality and depth requirement in Appendix III-C, and the designer must follow published practices for infiltration rate estimation and model representation.

In many cases, it will be difficult for a project to meet its treatment or flow control requirements completely through use of a bioretention facility. It will simply use too much space. That is the disincentive. But if that is what Pierce County wants to do at present, that is acceptable.

d. There should be some indication that bioretention facilities can be used to fully or partially meet treatment requirements too. WWHM and MGS Flood can be used to track the total amount of water predicted to infiltrate through the bioretention soil profile. Full compliance with the treatment requirement is infiltration of 91% of the post-development runoff file volume. Projects can also get partial treatment credit. For instance, if a bioretention facility is estimated to infiltrate 50% of the runoff file, a downgradient treatment facility need only demonstrate treatment of another 41 % of the post-development runoff file.

We appreciate the suggestion to make a more explicit statement on receiving partial credit for this BMP but believe it is stated in a way that meets equivalency. The first paragraph of this BMP (section 3.8 on page 3-8) does say "Bioretention area and rain gardes also provide water quality treatment…" The last bullet point of section 3.8.1 (pg 3-10) states the "facilities may met the requireemtn for basic and enhanced treatment (see volumes I and V) when…" As for partial use this is implied in the Overflow section (page 3-13) by recognizing that one facility may not fully infiltrate the entire runoff file and must provide an overflow to another acceptable discharge point.

OK. You might consider adding that properly designed bioretention facilities that have an underdrain meet the treatment requirements if runoff modeling predicts 91% of the influent volume has passed through the bioretention mix soil profile.

e. Within the "Underdrain" subsection, and possibly as a footnote to Table 3.1, a statement is needed that indicates that bioretention facilities with underdrains receive no credit toward meeting an applicable flow control standard. Underdrained facilities still get credit for meeting the treatment requirements. Ecology is pursuing updates to WWHM and MGS Flood that would allow modeling of underdrained facilities so that they get some credit for flow reduction.

This statement you are asking for is found on page 3-11 the last bullet in Setbacks and Site Constraints which is the first reference to underdrains, we feel this is the more appropriate location for the note. We understand with new BMP's being redundant can sometimes be

educational but it can also be confusing and cause potential inconsistancies when updating sections.

OK. Consider adding our last statement under d., above, to the last bullet on page 3-11.

f. The County must provide an explanation for how it arrived at the Rain Garden sizing guidance in Table 3.1 unless the County restricts use of the table to projects which do not exceed any of the following thresholds:

total effective impervious area is less than 10,000 sq. ft

effective PGIS is less than 5,000 sq. ft.

Lawn/landscape area is less than ¾ acres, or

A less than 0.1 cfs increase in the 100-yr flood frequency flow rate without any runoff controls.

Without the above restrictions, the County must demonstrate that the default sizes fully meet the treatment and flow control requirements.

The rain garden sizing guidance was originally based on a very conservative single event model and not a continuous simulation model. Initial results of building a new table using HSPF show the table has a safety factor of 6 over the minimum requirements. For example for a site with 2000 s.f. of Contributing Area and an Engineered Soil Depth of 1.5' the current table calls for a 833 s.f. bottom area for the rain garden and the HSPF model run calls for 133 s.f. (Key assumptions include: Ponding Depth (in) - 6"; Bioretention soil depth (ft) - 1.5' ft; Bioretention soil porosity - 0.4; Infiltration rate (in/hr) = 2.4; Side slopes (ft/ft) - 4:1). That this table will primarily be used for roof runoff from Single Family Residence construction make it overly conservative and could be a disincentive to utilize this BMP. We propose to propagate the table with results from the HSPF model using conservative assumptions and retain a safety factor of 2 or 3. This will still serve as an insentive to retain an engineer to do more detailed analysis that could reduce the size but still meet all the flow control and runoff treatment standards. As the table currently is written it meets Minimum Requirement 6 & 7 but we now believe to be overly stringent.

Use of the table for areas under 2,000 square feet is acceptable. If the County wants to expand use of the table to other situations or to change the sizing defaults, it will have to seek Ecology approval. For reasons indicated above, (e.g., unreliable infiltration rate assumptions for a wide range of allowed soil designs), Ecology would seek more definitive designs.

2. Section 3.15 Vegetated Open Channels

Subsection 3.15.3 allows for designs that include an underdrain system beneath the channel bottom. Any designs using an underdrain shall not be given flow reduction credits if the underdrain flow ultimately discharges to a freshwater which is not flow control exempt.

The requirements for flow control credit are addressed in subsection 3.15.2 **Flow Credit for Vegetated Open Channels** where the designer must demonstrate "how some or all the applicable flow control or water quality treatment requirements will be met". In 3.15.3 second to last bullet

(pg 3.47) discusses underdrain outfall targets but does not discuss flow credits, since that issue was addressed in the previous section

Ecology is concerned about how the County will make these decisions. At the moment, because we do not have a way to give partial credit for loss of water into the ground wherever a channel or swale or bioretention facility is underlain by a drain pipe, the direction is to give no credit. We are looking for a statement from Pierce County about their concurrence with this specific situation.

3. Section 3.18 Vegetated Roofs

The text does not have any references to flow reduction credits. The County should indicate the credits listed in Appendix III-C of the SMMWW at page C-10. You may also note that Ecology anticipates that a new method for modeling vegetated roofs should be available sometime in 2009.

Because of the great variability in vegetated roofs we decided to evaluate their use on a case-by-case basis (section 3.18.1 pg 3-60). In Chapter 4 (section 4.1 pg 4-1) we discuss modeling requirements and the County's ability to accept revised LID modeling and hydrologic analysis methods as approved by Ecology.

OK